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A comparative study of the physico-chemical properties and dietary fiber composition of Vietnamese cocoa bean and beans from other major cocoa producing countries

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INTRODUCTION

Cocoa (*Theobroma cacao* L.) is a major, crucial economic, global crop and has been maintained several nutritional benefits.
Cocoa beans are harvested from cocoa trees (*Theobroma cacao* L.) (Lecumberri et al., 2007) and provide enormous benefits to producing countries by boosting their economies as well as providing good nutrition to consumers (Aremu et al., 1995; Wood and Lass, 2008; Efombagn et al., 2009; Ha et al., 2015).
The exporting volume of Vietnamese cocoa bean is increasing in the world cocoa trade.

OBJECTIVE

Cocoa beans from five different cocoa producing regions namely Vietnam, Ghana, Ivory Coast and the Philippines were investigated for their physico-chemical properties and dietary fibre content (DF).

MATERIALS AND METHODS

Sampling preparation : Cocoa beans were dehusked, grinded and refined followed by AOAC 935.52 method at FTE lab (Ghent University, Belgium)

Experiment 1. Bean mass and bean size (Singh and Goswani, 1996; Aviara et al., 1999; Leishman and Murray, 2001; Bart-Plange and Baryeh, 2003)
Experiment 2. Chemical analyzing methods by AOAC (moisture, ash, lipid, dietary fibre and crude protein content)
Experiment 3. Statistical Analyses (Statgraphics Statistical version 20.0 for ANOVA and Duncan's multiple range test

Table 1. Sampling address

Country	Code	Collection Sampling address
Ghana	G	GFRI (Ghana Food Research Institute)
Ivory Coast	I	Ivory Coast (IC Cocoa Research Institute)
Philippines	P	Phillipines (Puentespina farm, Bolcan, Agdao Davao city, Philippines)
Highland	H	Highland Viet Nam (Mr.Nguyễn Văn Đoài plantation, Hà Lâm, Đạ Hoai, Lâm Đồng province)
Mekong Delta	M	Mekong Delta (Mr. Trần Hùng Sơn garden, Phú Đức, Châu Thành, Bến Tre province)

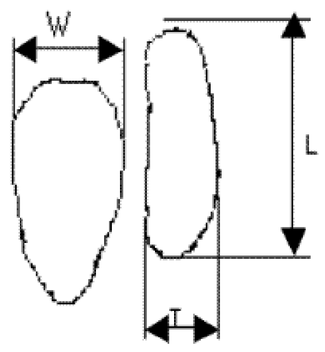

Figure 1. Cocoa bean's size and measurements (width, thickness and length)

RESULTS

Table 2. Cocoa bean dimension and mass

Country	Width (mm)	Thickness (mm)	Height (mm)	Mass (gram)
Highland	13,04ab	7,69b	23,01a	1.06c
Ivory Coast	12,12cd	7,44b	22,04b	1.01c
Philippines	13,38a	8,67a	23,39a	1.13bc
Ghana	11,65d	6,48c	20,82c	1.31a
Mekong Delta	12,63bc	7,66b	21,73bc	1.26ab

** P ≤ 0.01: significant at 1%. The values in each column followed by different normal characters are significantly different (Duncan test, P < 0.05).

Table 3. The chemical properties and DF content

Country	Moisture (%)	Lipid (%)	Ash (%)	Dietary fiber (%)
Highland	7,04b	13,44c	3,61b	65,29a
Mekong Delta	6,02d	22,45c	3,64b	59,45a
Ivory Coast	7,52a	33,61b	3,65b	48,16b
Philippines	6,18cd	43,58a	4,76a	61,97a
Ghana	6,36c	45,58a	3,54b	60,18a

** P ≤ 0.01: significant at 1%. The values in each column followed by different normal characters are significantly different (Duncan test, P < 0.05).

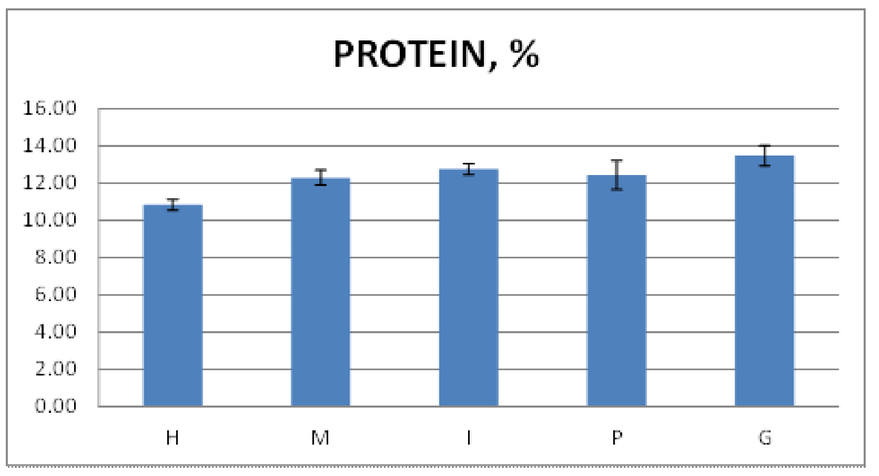

Figure 2. Crude protein content (mean plus standard deviation around the mean)

CONCLUSION

The cocoa beans from Highland Vietnam and the Philippines recorded the highest length of 23 mm. The beans from the Philippines were also the thickest with a diameter of 8,67 mm.
The fiber content of cocoa beans from Highland, Mekong Delta Vietnam, Ghana and Philippines were the highest with values ranging between 59,45-65,29 w.b. %.
Cocoa beans from Highland and Mekong Delta of Vietnam recorded the lowest concentration of crude lipid while the highest level of lipid component were recorded by the cocoa beans from Philippines and Ghana, with values ranging between 43 % and 45 w.b. %.
The cocoa beans from Ivory Coast recorded the highest moisture and ash content of 7,52 and 4,76% , respectively.

Acknowledgment
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